COURSE DESCRIPTION CARD - SYLLABUS

Course name

Termodynamika chemiczna i procesowa (Chemical and Process Thermodynamics)

Course

Field of study	Year/Semester
Technologia chemiczna (Chemical Technology)	II/3
Area of study (specialization)	Profile of study
-	general academic
Level of study	Course offered in
First-cycle studies	polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
		0
Tutorials	Projects/seminars	
30	0	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Wydział Technologii Chemicznej

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Responsible for the course/lecturer:

Prerequisites

Students:

have knowledge in general chemistry (writing chemical reactions, converting concentrations, knowledge of laboratory glassware and basic laboratory equipment).

have knowledge in mathematics and physics enabling the introduction of problems in physical chemistry (basic laws of physics, differential calculus).

are able to prepare solutions of specific concentrations.

are aware of further development of their competences.

Course objective

To familiarise students with basic problems in physical chemistry at the academic level in the field of: thermodynamic functions (the first and second laws of thermodynamics, the Gibbs free energy, thermochemistry,the thermodynamic equation of state), phase equilibrium – one-component and multi-component systems, surface and chemical equilibrium, colloidal systems and energy sources.

Course-related learning outcomes

Knowledge

Students will be able to formulate and explain the basic theories of surface phenomena, heat engines and energy sources. K_W03, K_W10

Students will be able to define the basic concepts and laws of thermodynamics, determine the basic limitations and scope of their applicability; describe phenomena and processes in thermodynamics. K_W03, K_W10

Skills

Students will be able to obtain information from literature, databases and other sources; interpret it as well as draw conclusions and formulate and substantiate opinions. K_U01

Students will be able to plan and carry out measurements of basic physicochemical parameters. K_U22, K_U23

Students will be able to apply the principles of thermodynamics in the implementation of chemical processes. K_U23

Students will have the self-study skills in the subject. K_U05

Students will be able to elaborate, describe and present results of an experiment or theoretical calculations. K_U09

Social competences

Students will be aware of the responsibility for jointly performed tasks. They will be able to work as a team. K_K03

Students will understand the need for further training and developing their professional competences. K_K01

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Execises: grade on the basis of points obtained for activity during classes, writing tests. Passing exercises from 60% .

Programme content

Physicochemical calculations in the field of:

Chemical thermodynamics

First law of thermodynamics. Heat balance of chemical reactions. Calculation of thermal effects based on table values. Heat capacity Cv and Cp and their dependence on temperature. Standardization of thermal effects of chemical reactions. Second law of thermodynamics. Determining the direction of chemical transformation. Entropy as a state function of direction. Thermodynamic potentials - calculating the constant equilibrium of chemical reactions. Determining the effect of temperature on equilibrium constant.

PHASE EQUILIBRIUM

Liquid – Vapour transition. Temperature dependence of vapour pressure, Clausius-Clapeyron equation. Raoult's law and Henry's law. Phase diagrams: liquid – vapour. Distillation, fractional distillation. Aseotropes. Gibbs phase rule. Phase diagrams: liquid - solid for the two component systems. Two and multi component systems. Thermal analysis. Cooling curves. Chemical potential of a component in ideal and real solution. Activity coefficients. Nernst's distribution law. Three component system. Phase diagrams: liquid – liquid. Extraction. Application of extraction process.

CHEMICAL EQULIBRIUM

Chemical equilibrium and thermodynamics functions. Thermal dependency of chemical equilibrium. Heat reaction and temperature dependence. Solubility equilibrium. Conductometry. Conductivity measurements of the electrolytes. Measurement cell construction. Heat reaction and determination. General principles of thermodynamics. Laws of thermodynamics. Internal energy and enthalpy. Molar enthalpy of formation, combustion, dissolution dilution. Calorimetry. Construction and types of calorimeters. Cells and cell types. Methods for measuring the electromotive force of a cell.

Teaching methods

Exercises with discussion. Deductive method. The exercises involve solving partial tasks and solving detailed problems.

Bibliography

Basic

1. K. Pigoń, Z. Ruziewicz, Chemia Fizyczna, PWN Warszawa 2013
2. P. Atkins, Chemia Fizyczna, PWN Warszawa 2019
3. L. Sobczyk , Eksperymentalna Chemia Fizyczna, PWN Warszawa 1982
4. P.W. Atkins, C.A Trapp, M.P.Cady, C.Giunta Chemia fizyczna. Zbiór zadań z rozwiązaniami
5. J. Demichowicz-Pigoniowa Obliczenia fizykochemiczne, Wydawnictwo Politechniki Wrocławskiej

Wrocław 1997

6. W. Ufnalski, Obliczenia fizykochemiczne, Wydawnictwo Politechniki Warszawskiej 1995

7. Instrukcje do ćwiczeń laboratoryjnych z chemii fizycznej

Additional

1. P. Atkins, Podstawy Chemii Fizycznej, PWN Warszawa 1999

2. L. Sobczyk, A. Kisza, Chemia fizyczna dla przyrodników, PWN Warszawa 1977

3. J. Minczewski, Chemia analityczna, PWN Warszawa 2005

4. H. Buchnowski, W. Ufnalski Wykłady z chemii fizycznej, WNT Warszawa 1998

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	35	1,4
Student's own work (literature studies, preparation for laboratory classes, preparation for tests and exam, preparation of the report.) [1]	15	0,6

[1] delete or add other activities as appropriate